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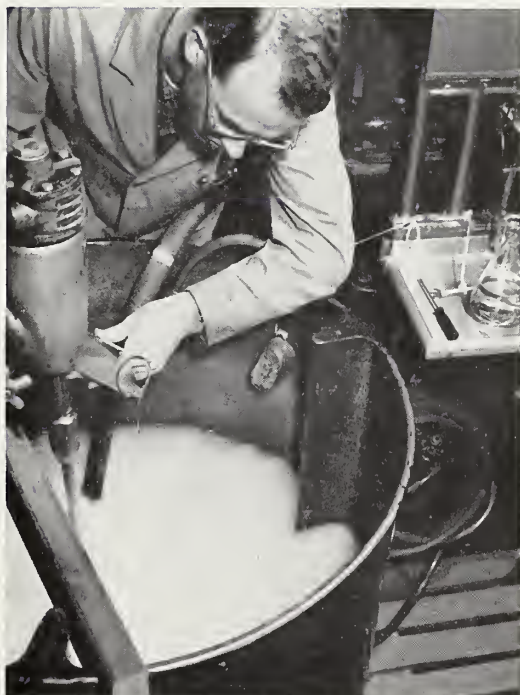


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May/1960

# AGRICULTURAL Research

U.S. Department of Agriculture



**STRONGER  
PAPER**  
*Page 13*



**LEANER  
HOGS**  
*Page 3*



**HIGHER  
QUALITY**  
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# AGRICULTURAL Research

Vol. 8—May 1960—No. 11

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## Change

Keeping this country's agriculture dynamic calls for the support of a dynamic agricultural research effort.

Agriculture is ever changing with changes in markets for farm products, with changes in farming itself. And our rapid adoption of technology often leads to further change. Research must not only keep pace with these changes but also anticipate problems arising from future changes.

USDA, with cooperation from State agricultural experiment stations and industry, is geared to work on agriculture's changing problems. Not *all* the problems, of course—we must select from the many problems that need attention those that can and should be attacked now. How do we decide?

Our research people receive the advice of farmers and others interested in agriculture, mainly through individuals and organizations. These include members of Congress and representatives of farm organizations, trade associations, and other groups. Research and Marketing Advisory Committees meet yearly to review our research and suggest changes in emphasis or direction. Each research proposal is carefully weighed for the importance of the problem to agriculture and to the Nation, as well as for the promise of the suggested line of work.

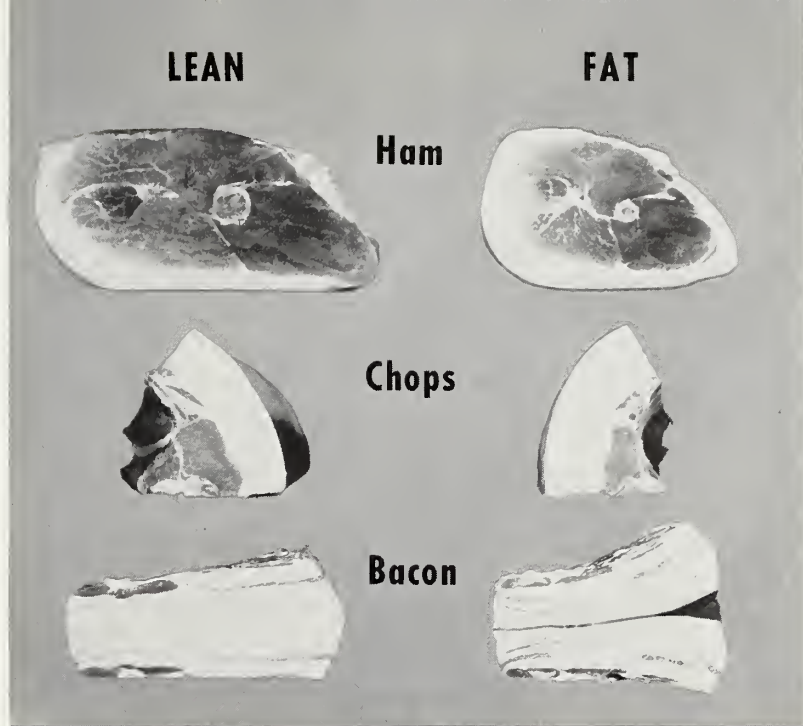
Furthermore, we conduct a continuing review of all USDA research so as to maintain the maximum effort on projects that we expect to produce the most useful answers to the most important problems. Every year, we close out completed or unpromising work and redirect funds from less urgent work to research on problems that are more critical at the time.

Deciding what projects should be undertaken or continued is always difficult at best. One reason is, of course, that the results of research can't be predicted. And research, to be most useful, must often be undertaken long before the problem it's intended to solve has become apparent.

Vital in our preparation for the unexpected is our increased effort on basic research aimed at finding new principles. This work lays a foundation for the main business of agricultural research—solving agriculture's ever-changing problems.

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*a progress report*



Yields of fifth-generation lean hog included 14 percent hams, 11 percent bacon, 11.7 percent loin, 3.55 square inches eye muscle area; fat hog, 11.6 percent hams, 11.3 percent bacon, 9.2 percent loin, and 2.11 square inches eye muscle area.

# LEANNESS

## Made to Order

*Selection intensifies leanness or fatness in long-range program to put meatier pork cuts on consumer's table*

■ Four generations of selection for high and low fatness in Duroc hogs show a widening lean-to-fat ratio, indicating that selection based on backfat thickness continues to be highly effective in changing carcass composition. Primary criterion of selection is backfat thickness at a live weight of 175 pounds (AGR. RES., Sept. 1958, p. 3). Backfat is measured by a lean-meter which makes use of the fact that fat tissues don't conduct electricity as well as lean tissues.

Backfat thickness in the Duroc foundation stock averaged 1.49 inches. This increased about 21 percent to 1.82 inches in the fourth generation animals specially bred for high backfat (high-line), and decreased about 17 percent to 1.25 inches in pigs bred for low backfat (low-line). Selection in Durocs has so far been somewhat more effective in increasing backfat thickness than in decreasing it.

Selection for high and low fatness has been carried through two generations in Yorkshire pigs, with backfat thickness averaging 1.26 inches in the foundation stock. This increased 5 percent to 1.32 inches in the second generation high-line pigs, and declined 5 percent to 1.20 inches in the second generation low-line pigs.

These studies are part of a long-range selective breeding experiment begun at USDA's Agricultural Research Center, Beltsville, Md., in 1954. The aim is to produce a meatier market hog and speed up production of high-quality breeding stock. Similar investigations are underway at several State agricultural experiment stations.

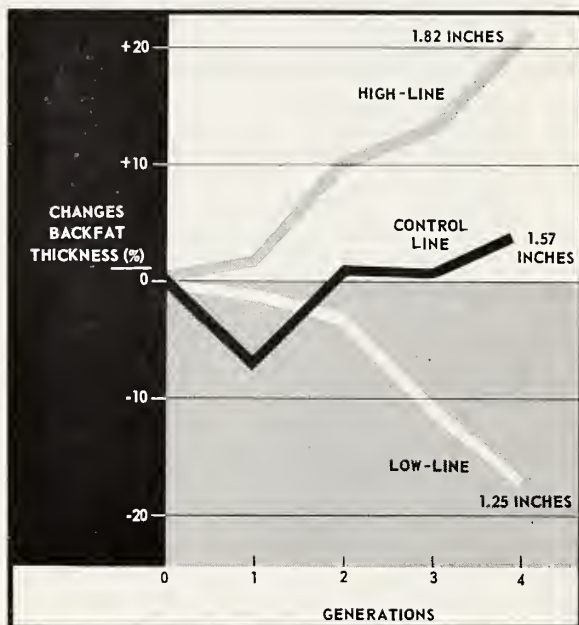
Along with changes in backfat thickness, high-line Durocs continued to decrease in weaning weight and in postweaning growth rate. These



Low-line fifth-generation Duroc displays lean streamlined shape so desirable in modern meat-type hog. Backfat thickness measured 1.22 inches at a probing weight of 176 pounds. Average gain from weaning until animal was probed was 1.40 pounds per day.



High-line fifth-generation Duroc gilt is short and chunky, a type once popular. Backfat thickness measured 2.20 inches at probing weight of 174 pounds. The gilt made an average daily gain of 1.29 pounds from weaning until probed for backfat thickness.



Widening lean-to-fat ratios continue to show up in hogs bred for high, low backfat. Backfat increased 21 percent in fourth-generation high-line hogs and decreased 17 percent in low-line hogs.



Trim lean carcass of fifth-generation low-line hog at left was 30.1 inches long. Backfat measured 1.58 inches at a 197-pound slaughter weight. High-line carcass at right was 26.4 inches long, measured 2.44 inches backfat at slaughter weight of 207 pounds.

## LEANNESS Made To Order

(Continued)

pigs averaged 29.7 pounds at weaning and made an average daily gain of 1.47 pounds from weaning to the time they were probed for backfat thickness at 175 pounds.

Low-line Durocs, on the other hand, continued to increase in both of these traits. They averaged 35.2 pounds at weaning and 1.58 pounds in daily gain from weaning to probing.

ARS geneticist H. O. Hetzer, who is conducting the breeding phase of the studies, attributes the differences in growth rate between the two lines to the fact that high-line dams tend to be lighter both at breeding time and when farrowing their litters. Dams of fourth-generation high-line pigs were 24 pounds lighter at breeding and 90 pounds lighter when farrowing than low-line dams. Thus, the nutrients that high-line sows provide to their offspring during embryonic development and the suckling period would certainly be less than those provided by leaner-than-average dams to their offspring.

In the Yorkshire lines so far, the responses of weaning weight and post-weaning growth rate have been opposite to those noted in the Duroc lines. The difference is probably due to the fact that the Yorkshires used in these studies tended to be larger and leaner to start with than the Durocs. A given change in fatness would thus have no immediate effect on the weaning weight and postweaning growth rate of Yorkshire pigs, while the same change would immediately become apparent in Durocs.

There has been no difference thus far in either litter size at birth or at weaning between the high and low lines, indicating that selection has had no adverse effects on sows' fertility or mothering abilities. Both Duroc lines averaged about 10 pigs per litter

at birth and 7.7 pigs at weaning in the fourth generation.

A significant feature of these studies—and perhaps of most interest to consumers—is the fact that high and low lines of both breeds are diverging rather steadily in several important carcass characteristics.

Fourth-generation low-line Durocs averaged 4.8 percent less fat than high-line Durocs, and surpassed high-line Durocs by 4.1 percent in yield of lean cuts and by 1.1 square inches of loin eye muscle area. On the basis of 200-pound pigs, those selected for leanness would yield 3.2 pounds more lean meat and 9.6 pounds less fat than high-line pigs.

Differences in carcass yields and measurements between high and low line Yorkshires are smaller, but they are pointing in the same direction as those in Durocs.

ARS food technologist R. L. Hiner and his staff at Beltsville are conducting carcass evaluations, including a study of the relation of the fatness or leanness to flavor. Tests have so far shown that the Durocs with more *intramuscular* fat—not backfat—produced the tastiest and most flavorful meat. Hiner suggests the possibility of future studies on lowering backfat thickness but retaining or increasing the intramuscular fat content to the most desirable level.☆

### Normal Millet Hybrids From Dwarf Plants

■ Forage yields of crosses between experimental dwarf millets indicate that seed of Gahi-1 or a similar pearl millet hybrid can be successfully produced on dwarf plants. Seed production of a new Gahi on dwarf plants would greatly facilitate mechanical harvesting. The hybrid seed itself would grow into plants of normal height and superior yield, like Gahi-1.

Gahi-1, developed by USDA and the Georgia Agricultural Experiment Station, is the hybrid resulting from interpollination of four inbred lines (AGR. RES., July 1958, p. 11).

Gahi-1 is produced by planting equal numbers of seed of the four inbred parents, which flower at the same time and interpollinate each other. Approximately 75 percent of the seed produced is hybrid and 25 percent is selfed or sibbed (seed resulting from self-pollination or cross-pollination between plants of the same line). When this seed is planted at the rate of 10 pounds per acre in 3-foot rows, the more vigorous hybrid seedlings crowd out the inbreds, giving the same yield response as pure hybrid seed.

Development of four dwarf lines which produce normal progeny when interpollinated was made possible by discovery of four different genetic factors controlling dwarfness in millet. Crosses between any two dwarfs result in normal plants.

Breeding is in progress to incorporate dwarf factors in the four parents of Gahi-1 and to develop dwarf lines of other inbreds. Test crosses between selected dwarf breeding lines showed 6 of 20 hybrids gave yields comparable to Gahi-1.☆



This machine applied EPTC below soil surface and produced better results than conventional surface spraying.

*New device demonstrates that volatile herbicides are more effective when used under soil surface*



## UNDERGROUND SPRAYING KILLS WEEDS

■ A new technique for applying volatile herbicides—subsurface application—increases effectiveness of these evaporative-type weedkillers, USDA-State experiments indicate.

This application technique was demonstrated with an experimental tractor-powered, two-row, rear-mounted cultivator-sprayer. The machine could be easily revamped for treating more than two rows at once. The sprayer applied EPTC (ethyl N,N-di-n-propylthiolcarbamate) herbicide in a thin band under the surface of seedbeds before cotton planting.

Such treatment resulted in 90-percent control of weeds, compared to 74-percent control when the chemical was sprayed on the surface of the soil and mixed in with a rotary hoe. Weed control was not increased by mixing the soil with a rotary hoe after subsurface spraying.

The research suggests that subsurface application may be an outstanding advance in weed control. Scientists and agricultural engineers believe the technique can be used several ways for applying various chemicals to control weeds in different crops. And herbicides could be applied before or during planting. However, the risk of crop injury would be reduced by planting after most of the herbicide evaporates.

Plant physiologist C. G. McWhorter of ARS and the Mississippi Agricultural Experiment Station and ARS agricultural engineer O. B. Wooten conducted the studies last spring at Stoneville, Miss.

They report that considerably less of certain chemicals is needed for subsurface spraying, because the herbicides are volatile and accurately placed for greatest efficiency in killing

germinating weeds. As these herbicides slowly evaporate, they move up through the soil and kill germinating weeds—even though the pests may not be in direct contact with the treated soil layer.

Volatile herbicides evaporate rather quickly when sprayed on the soil surface. (Much of this is caused by exposure to light and higher surface temperatures.) Weeds may not be controlled when they germinate slowly from lower soil depths. So the amount of chemical usually must be increased to insure good weed control.

### Depth of spray can be regulated

Main parts of the spraying device are two V-shaped blades, turned sideways. These blades move horizontally at depths of 2 to 6 inches—without collapsing built-up seedbeds. As a layer of soil is raised umbrella-

## A promising use for

# Gibberellic Acid

■ Treating seeds with gibberellic acid may be the answer for winter wheat varieties that emerge too slowly, USDA-State research shows.

In laboratory and field tests, slow-emerging varieties treated with gibberellic acid came up almost as rapidly as untreated, fast-emerging varieties. Rapid emergence is important to establishment of stands in the Pacific Northwest, where development of soil crust or compaction may prevent or deter growth of seedlings through the soil surface.

The tests were made by ARS geneticist R. E. Allan and agronomists O. A. Vogel and J. C. Craddock, Jr., in cooperation with the Washington Agricultural Experiment Station, Pullman. *Study and evaluation are continuing, and no recommendation for use is made at present.*

The slow-emerging varieties speeded up in the tests are Turkey, Brevor, and Lemhi (a spring wheat). Treatments were not as effective in aiding emergence of some semidwarf wheats now being developed (AGR. RES., August 1959, p. 3). Only one semidwarf selection was helped at a concentration of 100 parts per million. Efforts to breed out the poor-emergence characteristic are showing promise.

For Turkey, Brevor, and Lemhi, concentrations of 5 to 25 p.p.m. were most effective in stimulating emergence without harming plants.

In one field test, Turkey and Lemhi gave 47 and 44 percent emergence 9 days after planting, compared to 51 and 44 percent for untreated, fast-emerging varieties Nigger and Royal. Untreated Turkey and Lemhi showed 27 and 33 percent emergence on the same date. The seeds of Turkey and Lemhi were soaked for 4 hours in 20 p.p.m. gibberellic acid before planting.

In another field test, Turkey and Brevor gave 52 and 53 percent emergence 10 days after planting; when the seeds were untreated, emergence was 28 and 40 percent, respectively. Seeds were soaked for 4 hours in 5 p.p.m. gibberellic acid.

Treatments failed to speed up fast-emerging varieties, suggesting that they may already contain sufficient gibberellin-like substances.

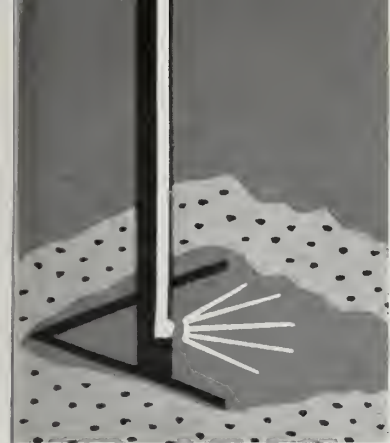
### Spray treatment of germinated seed speeds up breeding work

In other experiments to determine when and how gibberellic acid can be useful on wheat, State-USDA researchers noted these results:

Treatment stimulated emergence of spring wheat in cold, wet soils.

Spray treatments of germinated seed reduced the duration of the cold period usually required to induce winter wheat to flower. This will speed up breeding because more generations of plants can be grown in a year. The study was made by agronomist R. O. Weibel of the University of Illinois. Other researchers have shown that gibberellic acid treatments alone cannot substitute for the cold requirement.

In other tests at Pullman, yields were not improved by gibberellic acid given as an injection or as a foliage spray; the latter treatment, in fact, delayed maturity.☆



Herbicide sprays back from nozzles as V-shaped blade raises soil layer umbrella fashion. Built-up seedbeds are not collapsed during treatment.

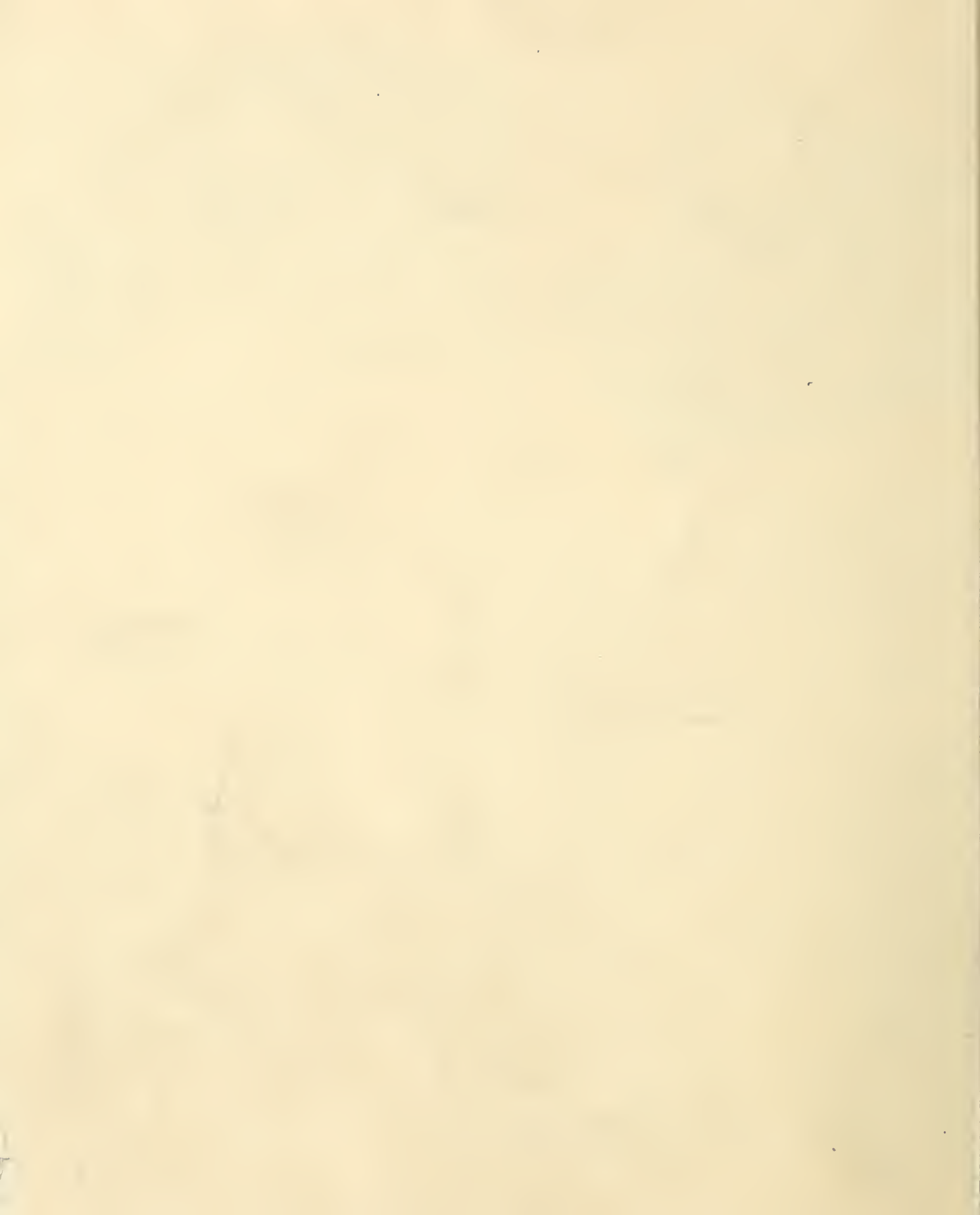
Combination blade and nozzle works at depths of 2 to 6 inches and in widths up to 16 inches. The spraying machine can be used in rows spaced 36 to 42 inches. Test setup could be revamped to treat more than two rows.

Each blade, herbicide is sprayed to the rear. Then the layers of soil fall, covering bands of treated soil about one-half inch thick and up to 16 inches wide.

### Test machine easily adjusted

Spraying can be done in various widths by changing and adjusting the nozzles. Other adjustments enable spraying in rows spaced 36 to 42 inches. One, two, or three nozzles were used to apply 5 pounds of EPTC in 40 gallons of water per acre to give a variety of herbicide distribution patterns. These nozzles operate under a pressure of 40 pounds per square inch and are installed in the V formed by each blade.

The device was effective at speeds up to 5 miles per hour in loam soils, but heavy clay stuck to the blades and hindered treatments.☆

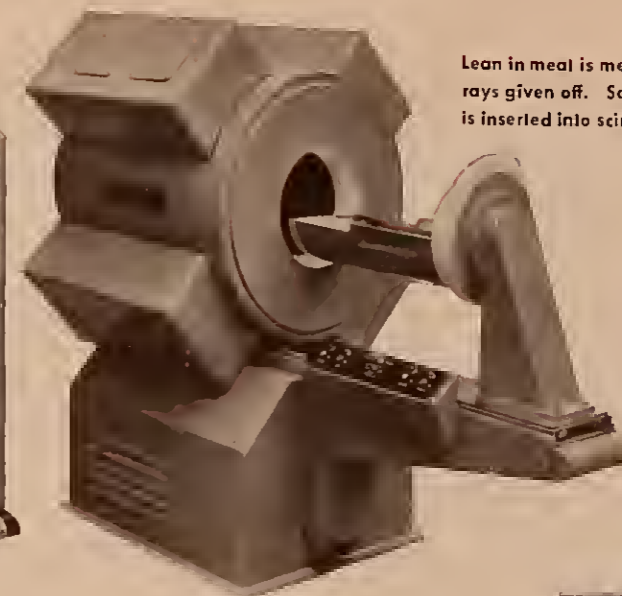




Wool sample fed into slot is carried on belt past photoelectric eye. Current breaks indicate staple length.



Seeds are counted, they drop off top of and interrupt light beam.



Lean in meat is measured by gamma rays given off. Sample placed on arm is inserted into scintillation counter.

Tomatoes for processing are graded by color of raw juice. Color index is based on measurements of three components of reflected light.



Peanut samples are taken automatically and accurately as peanuts pass through top cone-shaped device. Sample goes down pipe (arrow) to container for grading.



**Exact, scientific measurements eliminate guesswork from farm product quality determinations**

# Better Ways To Test Quality

■ Grading, testing, and inspecting services are becoming more efficient and rapid because of new equipment and methods developed through USDA's Agricultural Marketing Service research. They make possible objective measurements of quality on an exact, scientific basis that will mean better products for the consumer. Also under way is basic research on commodities and the characteristics that determine quality.

With some of the new equipment, peanuts can be sampled, shelled, and split automatically; grading tables can be better lighted; tenderness and texture in many foods can be measured with an electric instrument that indicates the effort it takes to cut or penetrate a substance; and the length of wool staple can be recorded photoelectrically.

Light is used to measure quality in farm products. One instrument, the Hortispect, is a spectrophotometer that shows maturity of prune-type plums by the type of light transmitted through the plums. A modified version of this instrument was used in measuring the smut content of wheat and damage in yellow corn. Another version, a dual monochromator, was used to detect small amounts of the plant-development pigment recently reported by USDA scientists (AGR. RES., November 1959, p. 31).

The electronic instrument developed to detect blood spots in white-shelled eggs has been modified to do the same thing for brown shells. Oil and moisture in cottonseed can now be measured by meters.

New chemical tests for quality factors include a quick method for determining protein content of wheat, a spot test for baking quality of nonfat dry milk, a sedimentation test for smut content of wheat, and new methods of staining bacteria. Hidden insect infestation can be found by a machine that submits individual kernels to a chemical test.

## Low intensity X-rays used in checking seed purity

Research in progress promises future achievements. The use of low intensity X-rays for purity analysis of seeds is being investigated and a trial instrument has been built to separate unfilled Bahiagrass seeds from the sound seeds. Basic equipment to determine if gamma rays

can be used in grading a variety of raw foods and food products for dry matter content and maturity has been set up preparatory to research on this subject. The potassium-40 isotope found naturally in animal tissues also emits rays of this type and may serve as an indicator of lean and fat in cuts and carcasses without destroying meat. A new type of gamma ray counter has been developed to test this possibility.

## Objective color grading possible with colorimeter

Chromatography has great potential for quality evaluation, and its application has hardly begun. (See AGR. RES., April 1956, p. 8.)

The trend toward processing commodities before they are marketed increases the importance of grading them in terms of the processed product. For example, in grading farmers' tomatoes to be used in manufacturing strained products, the newly developed electronic colorimeter is used for color grading raw juice. Such color evaluation is entirely objective and free from factors of human vision and color judgment.

Use of test processing facilities or pilot plants that simulate commercial operations has provided processing performance information on fruits and vegetables. This type of testing is beginning to expand to other commodities. For example, an experimental pilot facility was recently set up to study the characteristics of raw cotton fiber that are important in spinning quality. Current cotton quality tests give little indication of this important factor.

Not all problems can be solved by these direct research approaches, however. The quality attributes of many commodities are obscure and basic research on their biochemistry and molecular biology is needed before quality measurements can be devised. Such research combined with technological studies will provide a basis for quality definition and objective quality standards and measurements.

Long-range projects have already been initiated on such diverse problems as the palatability of meat and pork, the nature of disease agents in eviscerated poultry, and the biochemistry of seed germination.★

*Insect suppression by natural means offers hope for future; however, conditions favorable to this type of control still need much study*

## Parasites Control Grasshoppers

■ Outbreaks of grasshoppers on northwest rangelands have been drastically reduced after attacks by species of nemestrinid parasites, USDA entomologist H. W. Prescott reports.

For example, during a serious outbreak of grasshoppers on Montana wheatgrass range, nymph population in the second season ranged from 50 to 75 per square yard. There was an abundance of parasite flies, and by late summer 80 percent of the female grasshoppers were harboring parasite larvae. The infected grasshoppers produced few eggs and by June of the third year the grasshopper count averaged only one in 4 square yards, a decrease of more than 99 percent.

### Reproductive capacity reduced

Parasites reduce grasshopper egg production and shorten the lives of their hosts. In another study in north-central Oregon, population averaged 8 to 12 grasshoppers per square yard of rangeland with 70 percent of one species containing parasite larvae. The growing parasite larvae so interfered with the grasshoppers' reproductive system that few eggs were laid, and by the next July there was only one grasshopper for 4 square yards. Parasite flies again attacked and after the matured parasite larvae had emerged in September—killing

their hosts—grasshopper population was one in 20 square yards. Adults of another grasshopper species were nearly 100 percent parasitized, and died with the remains of dead parasite larvae within them.

The entomologists caged parasitized grasshoppers of three species to compare them with unparasitized insects. Parasitized grasshoppers survived from 24 to 34 days after caging, the unparasitized from 60 to 80 days. Parasite larvae emerged from 19 of 20 parasitized grasshoppers of one species (killing 75 percent of their hosts during the process); and

from 7 to 15 in another species. None emerged from the third.

Grasshoppers from which the parasite failed to emerge seemed to die of the effects of the dead and sometimes badly decomposed parasite larvae within them. Thus the parasite, even though it did not survive, was fatal to its host. The entomologists have not determined what it is in the grasshopper that kills the parasite larvae. In some species they die while small, in others they develop normally but do not emerge. The fatal factor in some hosts seems to be biochemical and in others physical.

### No flies found on cropland

Prescott found nemestrinid-parasitized grasshoppers on rangeland and idle land but never on cropland or cultivated areas. Apparently the flies avoid cultivated fields, and parasitized hosts do not migrate to these lands from the surrounding range.

Much remains to be learned about the factors that favor propagation of these parasites. In the search for natural means of effectively controlling destructive insects, entomologists are continuing to study parasites and other natural enemies.☆

Nemestrinid larva grows to large size within female grasshopper, interfering with its host's egg production. When the larva emerges, the grasshopper dies.



# HOW DO OLDER FOLKS SHOP FOR FOOD?

■ How well do older folks manage their food purchasing as related to their food needs?

To find out, economists Janet Murray of the USDA Institute of Home Economics and Gwen J. Bymers of Cornell University Agricultural Experiment Station analyzed information on purchasing practices in a study of the food consumption of 283 households in Rochester, N.Y. Each household included a beneficiary of Old Age and Survivors Insurance who lived alone or with one other person 55 years or over, with most of their meals prepared at home. Over 60 percent were between 65 and 75 years old, almost 25 percent were over 75 years, and 14 percent between 56 and 65 years.

Obtaining food supplies did not seem to be a special problem. Most of them did their own marketing. Only 9 percent of the one-person households and 3 percent of the two-person homes relied on someone else to market for them—usually because they were disabled.

In general, shoppers went to nearby stores and shopped only once or twice a week for food items. They often patronized large chain stores or supermarkets but also went to smaller grocers, delicatessens, or other markets. Only 1 out of 10 relied solely on the smaller stores. Most of them paid cash and carried their groceries. The householders said they went to a particular store because it was convenient, economical, and had good products. Sometimes it was patronized because of delivery service.

About half the householders obtained some items from route salesmen—usually milk and eggs, and sometimes bread, green vegetables, and fruit.

Most householders were satisfied with their food storage facilities although seven had neither a mechanical refrigerator nor an ice box. Only four mentioned inadequate storage facilities as a reason for frequent shopping. Most had only the ice cube compartment for storing frozen foods but—probably because food preparation habits were formed before frozen foods were on the market—they did not miss other freezer space.

Income averaged \$2,666 for two-person households and \$1,649 for one-person households. Expense of purchased food used at home for 1 week averaged \$15.54 and \$7.65 respectively, and ranged from \$2.47 to \$21.30 per person. Householders who spent the most for food shopped at more stores, traveled a little further to stores, and marketed more frequently. Householders with the lowest food expense shopped less often, and tended to shop at a store close to them, generally a supermarket or unit of a chain store.

Differences in marketing practices between households classified according to dietary level were slight in general, and such differences do not explain the adequacy or inadequacy of the households' diets. It is much more likely that the households enjoying better diets were more interested in food and hence marketed more actively.☆

# CLEANER COTTON FROM DOUBLE-DUTY DOFFER

■ Two jobs instead of one are performed by a new device designed by USDA utilization engineers in efforts to develop improved methods of cleaning cotton.

Known as a double-duty doffer, the device uses brushes to remove cotton lint from a pair of toothed cylinders on a machine that takes trash out of cotton. These brushes also act as blades of a centrifugal blower, helping to move the lint on for additional processing in preparation for spinning.

An added feature of the device is its ability to doff the cotton from two cylinders simultaneously. Other doffers, covered with various materials such as rubber or leather beaters, or metal teeth, remove cotton from only one cylinder at a time.

The new doffer operates in connection with cylinders on the recently developed SRRL aerodynamic cleaner (AGR. RES., February 1960, p. 10), an attachment for the SRRL opener (AGR. RES., November 1953, p. 3) and SRRL opener-cleaner. The aerodynamic cleaner greatly increases the trash removing capacity of the opener and opener-cleaner. They clean, fluff, and blend cotton from bales and have wide acceptance in industry.

A public service patent on the doffer was assigned to the Secretary of Agriculture. Several licenses, which allow nonexclusive production of the device, have been issued to textile machinery manufacturers.

The doffer was developed at the ARS Southern utilization division laboratory, New Orleans.☆

# BREEDING PINES TO YIELD MORE GUM

*Resin producers of the South may benefit from fact that trees' superior yielding ability is inherited*

## How Selection Increased Yield

0  
Each unit  
equals 100  
barrels  
per crop.

PARENTAL GENERATION		
AVERAGE TREES	(200 bbl.)	00
BEST TREES	(400 bbl.)	0000
FIRST GENERATION		
AVERAGE TREES	(300 bbl.)	000
BEST TREES	(600 bbl.)	000000
SECOND GENERATION		
AVERAGE TREES	(500 bbl.)	000000
BEST TREES		?



Eight-year-old progeny of slash pine selected for high yield of gum are hand pollinated and covered with plastic to prevent contamination through wind pollination.

■ The naval stores industry of the South can greatly increase its yield of pine resin in the future—if it breeds trees for higher resin yield.

USDA Forest Service researchers at the Lake City Research Center in Florida began selecting trees for high resin yield in 1941. A few of some 100,000 trees tapped for resin yielded more than twice as much as the average of all trees, or woods run. Controlled breeding tests on these few high-yielding trees showed that the tendency for high gum yield is inherited. Foresters are now starting orchards to produce seed of these superior trees.

### Substantial resin gains noted

How much gain can be expected from growing these selected trees? The original selections had slightly more than twice the yield of woods-run trees. First-generation progeny from original selections averaged 55 percent more resin for the group but did not equal the parents' record. However, the progeny of the *better* half of the selected trees yielded twice as much as woods-run trees—the parental yield—and the *best* progeny of the *best* selected trees gave nearly three times as much resin. Seed orchards established from these very best trees might give progeny with about two and one-half times the resin yield of the woods-run trees.

In terms of quantity, the average yield of woods-run trees is 200 barrels of gum per crop of 10,000 faces. (A face is the chipped area—usually one or two per tree.) The average of all progeny of the original selections would yield about 310 barrels per crop, and the very *best* progeny of the *best* selections might yield about 500 barrels.☆



Dialdehyde starch added to pulp (left) produced paper with wet strength over nine times that of untreated papers. Some papers had wet strength up to 30 percent of dry strength, even after 30 minutes in water. This treatment also produced more dry strength. The treated paper is rolled (right) after finishing.



Treated paper supports a load that is nine times greater than weight that breaks untreated paper, showing how the starch increases wet strength.



## New use for Cereal Grain

*Three surplus crops can be used in making better papers*

■ A practical procedure for adding dialdehyde starch to paper pulp to improve wet strength in paper has been developed by USDA chemists.

This advance follows announcement last spring of an improved process for economical production of the dialdehyde starch itself. It can be made from corn, wheat, or grain sorghum—all crops presently in surplus. Industry is now producing this chemically modified starch commercially, but the use of dialdehyde starch in paper products is still experimental.

ARS chemists at the Northern utilization division in Peoria found that dialdehyde starch at levels of 0.5 to 2.5 percent in pulp produces papers with excellent wet strength. Dry strength also increased compared with that of untreated paper. Maximum wet strength developed when starch was added with alum at a pH of 4.5. The presence of alum helps keep the starch in the pulp through the paper manufacturing process. Dialdehyde starch can be recovered from scrap paper by a mild, mechanical, hot-water treatment. This recovery is important in re-processing operations.

Adequate wet strength was developed when starch was

added at a range of 0.5 to 1 percent of the dry weight. With increased dialdehyde starch content, papers were produced having wet strength up to 30 percent of their dry strength after 30 minutes soaking in water. Some treated papers had more than nine times the wet strength of papers made without dialdehyde starch.

Industrial adoption of the new findings on use of starch in paper would allow this material to compete in a market with a potential annual capacity for 48 million pounds. Three-fourths to 1½ million bushels of corn would be needed to provide dialdehyde starch if it were used at the 0.5 to 1 percent range. About 2.4 million tons of wet-strength papers are now produced annually in the United States.

Some uses for wet-strength paper include paper toweling, bathroom and facial tissue, outdoor posters, shipping sacks, grocery bags, frozen food wrappers, and photographic and filter papers.

Earlier research indicated that dialdehyde starch has substantial promise as a tanning agent with advantages over vegetable tannins. (See AGR. RES., December 1957, pp. 4-5.) ☆

*Corn was dried better and faster by a solar dryer, using 50 percent less electricity, than by a conventional system*

## DRYING CROPS WITH SOLAR ENERGY



■ Farmers may soon be using solar-heated air for more efficient and less expensive grain drying.

Corn was dried better and faster by a solar-heated-air system than by a conventional unheated-air system in initial experiments of Kansas and USDA agricultural engineers. And fans of the solar installation used about 50 percent less electricity. Early results are so promising that studies will continue.

### Solar drying is more uniform

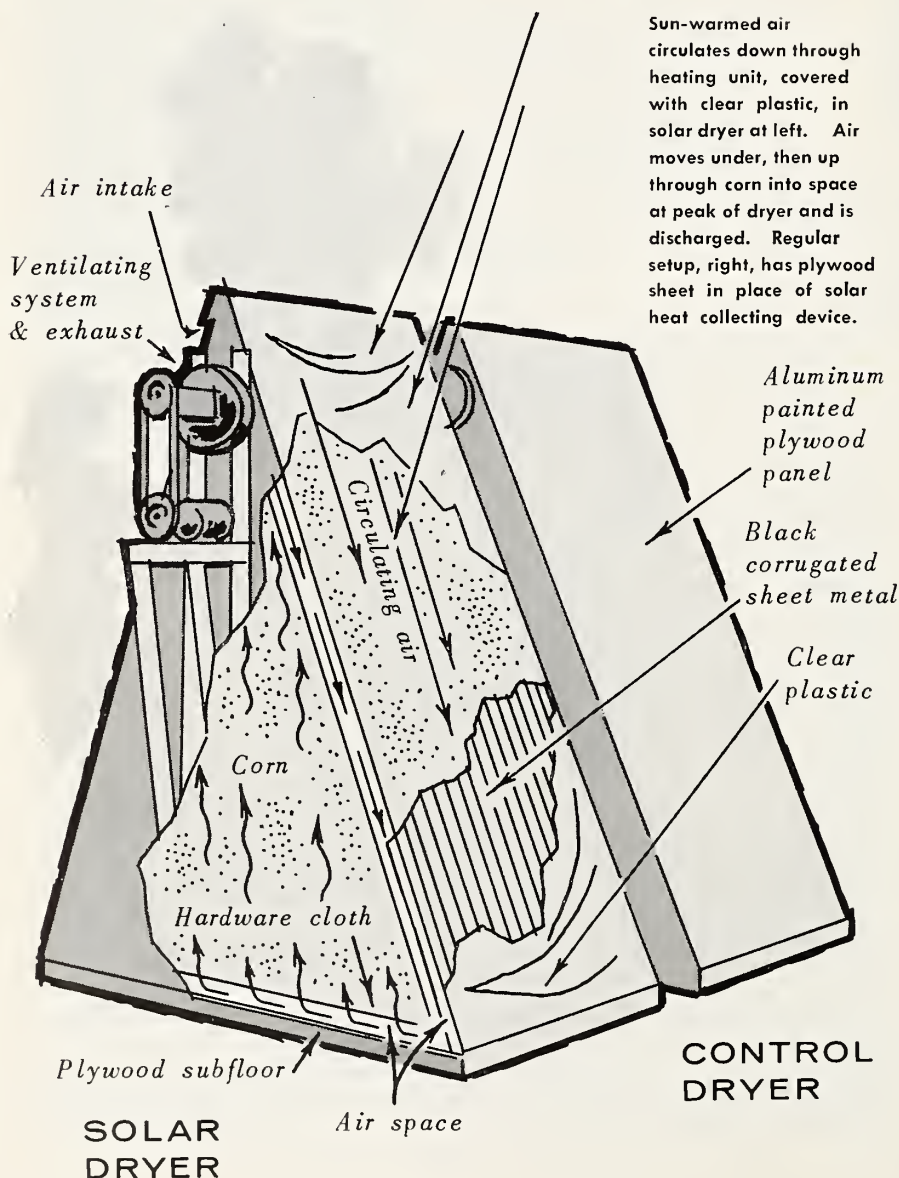
In 1 week, solar-heated air reduced the moisture content of 100 bushels of corn to 11 percent—from 17 percent. Similar corn was dried by unheated air to 12 percent moisture in the same time, but portions of the top layer still contained 14 percent moisture. While overdrying occurred in each bottom layer of corn, it was somewhat greater in corn that was dried by the solar-heated air. Both systems delivered air continuously at 4 cubic feet a minute.

R. I. Lipper of the Kansas Agricultural Experiment Station and C. P. Davis, Jr., of ARS offer these preliminary observations:

It appears that grain containing up to 18 percent moisture can be dried adequately by using a solar-heated-air system—even when the sun shines only 3.5 to 6.5 hours a day.

Because of faster drying, a solar-heated-air setup will use only about half the electricity that is needed for moving unheated air. This will be true whether air flow is continuous or fans are controlled to operate only when the relative humidity is less than 85 percent.

Where in-storage drying is used, it is unlikely that any profit can be made by increasing the flow of solar-heated air above that normally recommended for unheated air systems. A greatly increased air flow usually results in much faster drying, but adds to the cost for electricity.☆



## Newton named coordinator

Roy Chester Newton, a leader in the industrial utilization field for many years, has been appointed to a new post as coordinator for utilization research in USDA.

The appointment further emphasizes research to find new industrial outlets for profitable use of agricultural commodities, especially those that may be in surplus.

Newton will review all utilization research and development work, including that being done under Federal grant funds and under contracts and grants in institutions in this country and abroad.

He holds a Ph. D. in chemistry from the University of Chicago and was vice president in charge of research for Swift and Company until his retirement on May 1, 1959.

## Test plants not damaged

Tramping through experimental cotton plots and handling the plants retards growth, but State-USDA studies show the effects are temporary. So researchers can continue necessary operations—apply chemicals such as plant-growth regulators, hand pollinate, and attach tags—without fear of obtaining plant measurements that are misleading.

Scientists of ARS and Arkansas Agricultural Experiment Station, Fayetteville, studied effects of plant age, methods and duration of handling, effects of soil compaction among rows, and effects of handling individual flowers on plant size, and pollination and fertilization.

Significant height reduction occurred when handling was initiated on 30-, 45-, or 60-day-old plants. Height was usually reduced in pro-

portion to amount of handling—the longer the handling, the greater the reduction. This was greatest when terminals or stems were handled.

Plant height was reduced regardless of handling method, whether with the hands or with a stick or with rubber gloves. This finding ruled out the possibility that some “substance” might be transferred from hands to plants and thus reduce size.

Handling had little effect on pollination in individual flowers and no effect on number of bolls set or shed, boll size, earliness, or yield. Soil compaction due to walking among plots had no effect on plant size.

## Curly top early invader

Curly top, a destructive virus disease of sugar beets, tomatoes, and beans, may have invaded the United States during the gold rush, USDA scientist C. W. Bennett suggests.

During the 1850's, shiploads of immigrants reportedly came to the California gold fields from the Mediterranean area, bringing goats and cattle with them. Turnips and the fodder beet, a close relative of the sugar beet, generally were used as forage for livestock on the ships. Feed probably was discarded at west coast ports and could have contained the beet leafhopper.

This insect, only known vector of curly top virus in North America, is a native of the Mediterranean area and has no close relatives here.

## More root rot resistance

US-10 is a new safflower that appears more resistant to phytophthora root rot and adapted to a far greater area than Gila, a similar variety.

The new safflower is recommended

for Arizona, California, and Utah, while Gila is suggested only for Arizona. Preliminary tests indicate US-10 also can be grown in Idaho, Montana, Nebraska, and Wyoming.

ARS plant pathologist C. A. Thomas developed US-10. It was tested by the Arizona, California, and Utah



Agricultural Experiment Stations.

Except for resistance to root rot, US-10 is nearly identical to Nebraska-10, the principal safflower grown as a dryland crop in the United States. A cross of Nebraska-10 and Western Oilseeds-14, backcrossed six times to Nebraska-10, produced US-10. Resistance of Western Oilseeds-14 to root rot was transferred through these backcrosses to US-10.

Certified seed growers are increasing stocks of US-10 for considerable planting in 1961. Information on seed sources may be obtained from the California station at Davis. No seed will be distributed by USDA.

## Controls for sheep sorrel

Sheep sorrel, a serious lawn and turf weed, can be reduced by proper lime and fertilizer applications to stimulate turf growth, according to ARS agronomist F. V. Juska. Herbicide treatments may be desirable as a supplemental control.

In tests at the Agricultural Research Center, Beltsville, Md., application of 138 pounds of lime per 1,000 square feet and a complete fertilizer in spring and fall drastically reduced a heavy infestation of sorrel in common Kentucky bluegrass and red fescue. The dense turf resulting from the appli-

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cations crowded out the weed. The lime raised soil pH from an acid 4.5 to neutral 6.5, desirable for turf.

Of the herbicides tested, 2,3,6-TBA and polychlorinated benzoic acid (PBA), applied at the rates of 2 and 4 pounds per acre respectively, gave the best results.

### Improved binder tobacco

Many Wisconsin growers of cigar binder tobacco this year are expected to plant Havana 501—a new variety that is the first of its type having combined resistance to three serious tobacco diseases—wildfire, mosaic, and black root rot.

Commercial growers, whose crops were often injured by these diseases, requested development of the new variety. It was produced by tobacco specialists W. B. Ogden of ARS, R. W. Fulton and T. W. Tibbitts of the Wisconsin Agricultural Experiment Station, and the late J. Johnson of ARS and the Wisconsin station.

Growers of tobacco damaged by wildfire or mosaic are advised to plant



Havana 501. All others are advised to continue planting Havana 142 or Havana 307. Certified seed growers only are distributing Havana 501 seed.

The new variety and Havana 142 yielded about the same in 1959, a cool

wet season that caused much root rot in test plots at Madison, Wis. But yields were significantly greater than those of standard varieties not as resistant to root rot. Yield and quality of Havana 501 were as good or better than standard varieties grown during the dry 1958 season.

Havana 501 is similar in plant shape to Havana 142 and matures about the same time. The new variety produces a wider leaf, longer stem, and fewer suckers than Havana 142, but has slightly more brittle leaves.

A cross of wildfire-resistant T. L. 106 and Havana 211—followed by repeated backcrosses to Havana 307, Havana 322, and mosaic-resistant N 14-3—resulted in Havana 501.

### Compound reduces appetite

Dairy heifers eat sparingly and grow slowly when fed silage made from freshly chopped unwilted grass-legume mixtures. USDA dairy nutritionists L. A. Moore and J. W. Thomas of the ARS Agricultural Research Center, Beltsville, Md., believe some unidentified organic compound formed during fermentation of silage decreases the animals' appetites.

Isolation and elimination of this compound may make unwilted grass-legume silage as valuable as hay for feeding dairy animals. The compound also affects the appetite of mature cows, causing a decrease in milk production in some cases.

Heifers ate about twice as much dry matter when eating wilted silage

as they did when eating unwilted silage. In fact, there was little difference in consumption of heavily wilted silage and hay.

The scientists suggest that farmers wilt their crops a few hours before



ensiling, even though this involves mowing before chopping. If silage isn't wilted, some hay should be included in the ration.

### Two new durum wheats

Two new durum wheat varieties, with better resistance to race 15B stem rust than any variety presently available to growers, have been released by USDA and the North Dakota Agricultural Experiment Station.

The new durums—Wells and Lakota—ripen earlier, have shorter and stronger straw, and yield as well or slightly better than varieties now in commercial use. Both varieties display good characteristics for production of semolina flour, the basic ingredient of macaroni.

Seed of the new durums was available only from the North Dakota station at Fargo for increase next summer in that and nearby States.

The Wells and Lakota varieties were selected from a cross first made in 1952 between Sentry, another durum, and a progeny of a cross between varieties Ld 379 and Ld 357.